

Study on Cytoplasmic polyhedrosis virus on *Dendrolimus superans*¹

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Abstract A strain of Cytoplasmic polyhedrosis virus (CPV) was separated from the infected larva during the re-search of integrated pest management of *Dendrolimus superans*. The morphology, bioassay, histopathology and field-test for this CPV were studied. The size of CPV is $0.16\ \mu\text{m} \times 1.57\ \mu\text{m}$ and the virion is $16.0\ \text{nm} \times 58.1\ \text{nm}$. The L_{50} to the 3rd and 5th instar larva of *Dendrolimus superans* were 2.81×10^4 PIB/mL and 7.17×10^4 PIB/mL respectively. The polyhedrosis were formed after midgut of larva were infected for 72 h. A large amount of polyhe-drosis was formed after 144 h. The mortality was more than 82% and average mortality was 84.62% when using 1.17×10^8 PIB/mL virus suspension to control the pest in field test.

Key words: *Dendrolimus superans*, Cytoplasmic polyhedrosis virus, Bioassay, Pest control

Cytoplasmic polyhedrosis virus (CPV) of *Dendrolimus superans* (DsCPV) is one of the important patholo-gens of the larvae of *Dendrolimus superans*. In order to utilize DsCPV in control, the morphology, toxicity, infection and destroying procedure in the midgut of insect of DsCPV were studied. The control of *Den-drolimus superans* with this virus in a small area in forest was carried out.

Research method

Morphology observation

Scanning electron microscope and transmission electron microscope were used to observe the mor-phology.

Toxicity testing

The same amount of larch needles were immersed with 5 kinds of concentrations from 1.168×10^3 PIB/mL to 1.168×10^7 PIB/mL. After immersed needle dried, 3rd instar larvae were inoculated respec-tively. 5th instar larvae were treated with 5 kinds of concentrations from 1.056×10^3 PIB/ml to 1.056×10^3 PIB/mL.

Histopathology

The needles were immersed by 1.168×10^5 PIB/mL DsCPV suspension, and after dried, were fed by 3rd and 4th instar larvae that had been hungry for 10~12 h. The feeding was carried out at above 20 °C. Sam-

ples were selected and fixed regularly (Yan *et al* 1993).

Results

The morphology of DsCPV

Morphology of DsCPV

Polyhedron may be hexagon, pentagon and sphere shapes or no regular shape(Liu 1992). The smallest was $0.16\ \mu\text{m} \times 0.63\ \mu\text{m}$, the biggest was $1.02\ \mu\text{m} \times 1.57\ \mu\text{m}$ and the average was $0.76\ \mu\text{m} \times 1.02\ \mu\text{m}$ (see Fig. 1).

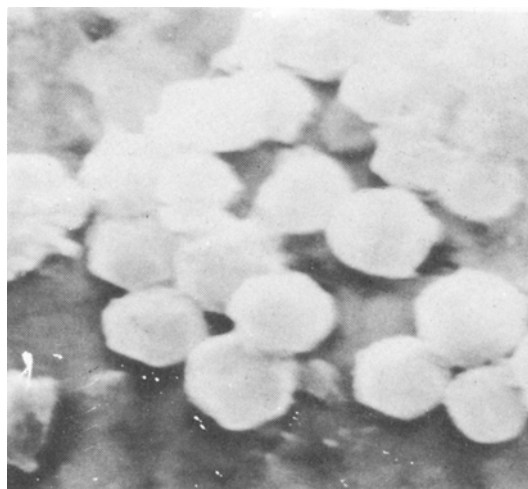


Fig.1. The photo of DsCPV by scanning electron micro-scope ($\times 20000$)

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Morphology of virion

The virion is sphere and twenty-hedron. The smallest was 16.0 nm, the biggest 58.1 nm, and the average was 35.8 nm (see Fig. 2)

Toxicity of DsCPV

The bioassay of 3rd and 5th larva of *Dendrolimus superans* was carried out respectively (see Table 1 and Table 2). The concentration logarithm and mortality probability values were calculated according to Table 1 and Table 2. L_{C50} to 3rd and 5th instar larvae was 2.81×10^4 PIB/mL and 7.17×10^4 PIB/mL respectively.

The symptom of *D. superans* infected with DsCPV and histopathology

Symptom

At the beginning, the larva infected with DsCPV has a poor appetite, and acted slowly. Later, the body showed withered, bigger head in proportion to its body, elected bristle, and the midgut swelled and become white.

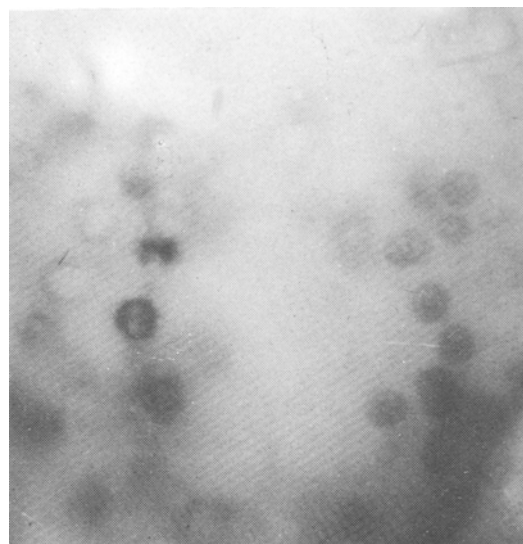


Fig. 2. The electron microscope photo of larvae midgut cells of *D. superans* ($\times 12000$)

Table 1. The results of toxicity testing of 3rd instar larvae infected with DsCPV

Concentration /PIB \cdot mL ⁻¹	Number of dead tested larvae	Dead number	Mortality %	Modified mortality %	Probability
1.168×10^3	52	15	28.85	28.85	4.42
1.168×10^4	55	22	40.00	40.00	4.75
1.168×10^5	50	32	64.00	64.00	5.36
1.168×10^6	60	45	75.00	75.00	5.67
1.168×10^7	58	51	87.00	87.00	6.18
Contrast	50	0	0	—	—

Table 2. The results of toxicity testing of 5th instar larvae infected with DsCPV

Concentration /PIB \cdot mL ⁻¹	Number of dead tested larvae	Dead number	Mortality %	Modified mortality %	Probability
1.168×10^3	60	16	26.67	26.67	4.39
1.168×10^4	60	22	36.67	36.67	4.67
1.168×10^5	60	29	47.54	47.54	4.95
1.168×10^6	59	38	64.41	64.41	5.36
1.168×10^7	58	48	82.76	82.76	5.95
Contrast	50	0	0	—	—

Histopathology

The normal midgut epithelium cells of larvae were tidy and compact (see Fig. 3). The polyhedrons were formed in midgut epithelium cytoplasm after the larvae were infected with DsCPV for 72 h. at above 20 °C (see Fig. 4). Lots of empty holes appeared in the cytoplasm after 114 h (see Fig. 5). A large sum of polyhedrons appeared in midgut after 114 h (see Fig. 6). A large sum of polyhedrons suspension was sprayed with motor-driven sprayer in larch forest. After infected with the DsCPV, the larvae of *D. superans* were attached to the branches. The mortality was recorded (see Table 3).

Summary and discussion

The polyhedrosis began to be formed in midgut epithelium cells cytoplasm of 3rd and 4th larvae of *D. superans* infected with DsCPV after 72 h, at above 20 °C. And a lot of polyhedrons were formed after 144 h, which indicated that the incubation period of DsCPV was short and DsCPV could cause disease quickly.

DsCPV has a high toxicity, and its control result is good. The studies on the artificial breeding and utilization in forest of DsCPV should go on further.

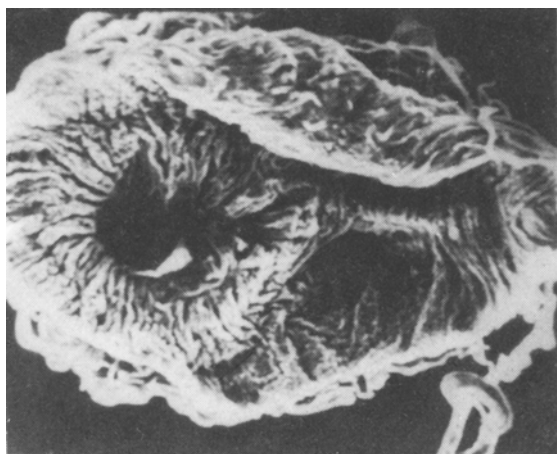


Fig. 3. The electron microscope photo of normal larvae midgut cells of *D. superans* (x600)

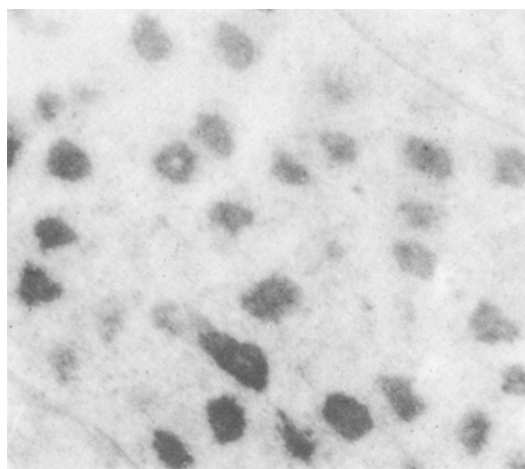


Fig. 4. Polyhedrons formed in midgut cells cytoplasm of *D. superans* infected with DsCPV after 72 h (x12000)

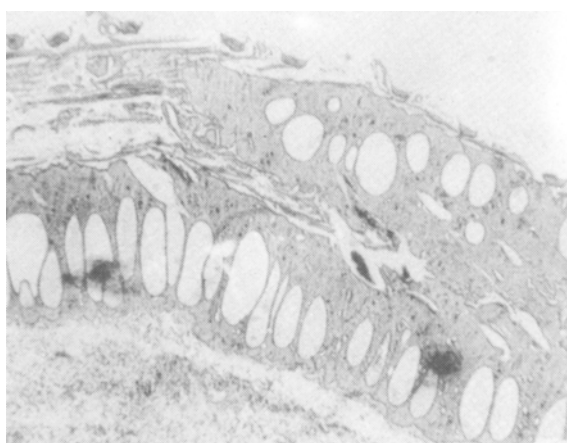


Fig. 5. Many empty holes formed in midgut cells cytoplasm of *D. superans* infected with DsCPV after 114 h (x312.5)

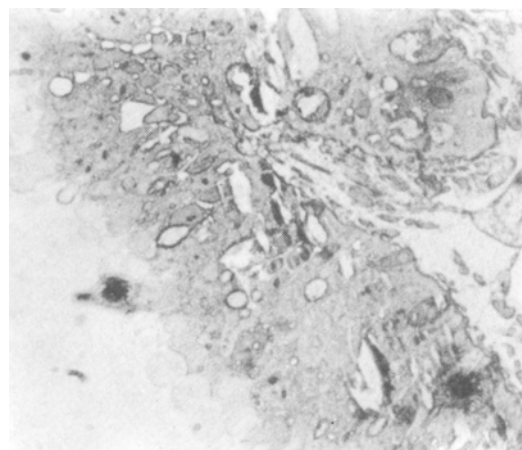


Fig. 6. A large sum of polyhedrons appeared in midgut cytoplasm of *D. superans* infected with DsCPV after 114 h (x800)

Table 3. The results of control the 3rd instar larvae of *D. superans* using DsCPV

Repeat	Concentration /PIB · mL ⁻¹	Number of test- ed larvae	Dead number	Mortality %	Modified mortality %	Average mortality %
1	1.17×10 ⁸	70	60	85.71	85.12	84.62
2	1.17×10 ⁸	70	58	82.86	82.14	
3	1.17×10 ⁸	70	61	87.14	96.60	
contrast	pure water	50	2	4.00		

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